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Is stock market making investors sick – evidence from Finland

BACHELOR´S THESIS

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Introduction

Engelberg and Parsons (2016) used hospital admission data from 1983 to 2011 in the state of California to study effects of stock market declines on investor health. They found evidence that decreases in the daily stock market return did make hospital admissions go up significantly, especially among mental illnesses. I am conducting the similar kind of study with Finnish data, as it has not been done before and surprisingly the data was available. The Centre of Health and Welfare in Finland (THL) started gathering daily hospital admission data not until the beginning of 2014. Thus, the data set includes only three years, which inevitably lowers the statistical power of my study compared to the benchmark study (28 years).

In financial theory models, stock price formation is often motivated by the future predictions of companies. This study examines changes in future wealth expectations on today's health if stock price movements are interpreted as a proxy for future well-being.

Finnish and American healthcare systems vary a lot by nature. In Finland the access to healthcare is guaranteed for larger proportion of people, as great part of it is supported by government. In the U.S. the system is different, and fewer people can access proper healthcare. Therefore, it is reasonable to state that people tend to use healthcare services easier in Finland, which I think makes hospital admissions less affected by stock market movements.

Another interesting aspect is to analyze the effect on national budget. If stock market declines were to increase hospital admissions, would Finland´s economy face both loss of market value for companies and larger public health care costs for government.

Finnish investors tend to have a bias of holding unexplainably high proportion of stocks of Finnish companies in their portfolios (home-bias). This helps me to use home market data as a justifiable proxy for Finnish investors ownership. Portfolio considerations are out of the scope of this study, as personalized portfolios cannot be formed due to lack of personal data. I am using the OMXH25 market index of Helsinki Stock Exchange as a proxy for average Finnish investor portfolio. The index includes the top 25 Finnish companies and is obviously value weight averaged.

The question of relation of stock market performance in investor health can be addressed in many ways. If investors consider the value of their portfolio as an indicator of future wealth and utility, large fluctuations in its value would inarguably affect their (mental) health.

Finance is a science heavily relying on hard facts and numbers. In this study, I am taking a more humane approach, to explore the effects on the health side of people. In Finland, the subject has not been studied a lot this far, probably because of the lack of data.

In recent studies, the results have been similar to what Engelberg and Parsons in California. As Choi (2016) found out, suicide rates are associated with stock market returns in the US.

The rest of this paper is organized as follows. First, I will introduce the sources of data and scales of measurement. Then in Results section I will present my findings and explain how the study was done in practice. In section 3 I will discuss the limitations of this study. Finally, in the last part I conclude the paper.

Measurement and data

Health

Measuring investor health is not self-evident. From various possibilities, I use daily hospital admissions as a proxy for investor health following Engelberg and Parsons. The obvious advantage of this approach is that hospitalizations are not reported by individuals themselves. For example, a survey where people are asked to report their situation by their own, people are prone to estimate wrong, most likely upwards by intuition. Also, the timing of the survey would cause major difficulties, as roughly same amount of answers would be needed every day and the sample could easily be biased.

My approach has also disadvantages. First, hospital admissions do not easily catch the effect of improvement in investor health. Decline in the amount of admissions on good stock market days will not likely show the relation. That defines the scope of this study towards stock market decline events instead of overall fluctuations. Second, allowing the hospital admissions for all citizens, it is unclear how affected an average citizen is of stock market movements. Only a fraction of Finns can be labeled as professional investors, so most of hospital admissions will

happen for other reasons. Third, even if investor state of health temporarily suffered, not all are able or willing to be admitted to hospital.

I got the daily hospital admission data from the Center of Health and Welfare in Finland (THL). Starting from year 2014, they have collected detailed patient information of every visit in hospitals in Finland. The data of year 2017 were not yet available for this study. Individual patient records that could be assigned to particular persons are against the law in Finland, which limits the research use of the data for example individual portfolio considerations. Thanks to the friendly crew of THL, I got the data sorted by day, sex, diagnosis and age group. This allowed me to test different effects by sorting the data, most importantly with the mental illnesses.

The diagnosis codes from F00 to F99 are assigned to mental illnesses. For example, code F10-F19 are for brain symptoms following usage of alcohol or different drugs. On the other hand, F30 is for mania and F33 for depression.

Stock market

The stock market data is collected from Thomson-Reuters Datastream. The daily values of OMXH25 index for the three-year sample are used to calculate daily stock market return. The daily return is defined as the percentage change in the closing price.

Finally, the two datasets are merged to be able to study the daily values and effects.

Figure 1. As Figure 1 illustrates, the hospital admission data reflects great seasonality. In Finland, seasons differ a lot in nature, so people are more vulnerable to be admitted to hospital during cold months than the warmer ones. Adding seasonal factors to the study was mandatory to increase the R-squared and reliability. January is an exceptional month, as for some reason the admissions drop also in January, which is shown in the graph.

Admissions have also significant day fixed effects. Figure shows a typical pattern during a week outside holiday season, which is a notable decrease in admissions towards the end of the week. One basic reason to access healthcare is to get sick leave. The need for sick leave decreases towards the end of the week, as normally people do not need to go to work during weekend anyway. The similar kind of effect can be observed before specific holidays such as 1st of May, Midsummer, Independence Day and Christmas.

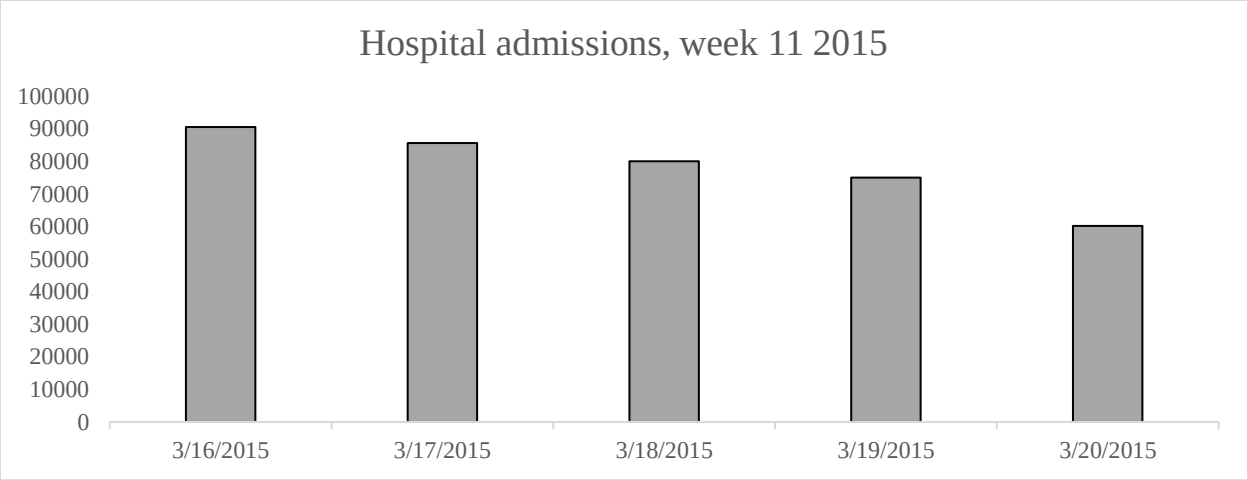

Figure 2. Daily hospital admissions during a 5-day week in March 2015. It was randomly selected to show the decreasing pattern of admissions along a week. The observation is similar in the whole data set.

Table 1 shows the overall statistics of the data. During sample period, an average of 76,092 people got admitted to hospitals every day. Due to highly cyclical pattern of rush in the start of the week followed by steady decline towards the end of the week, the standard deviation is as high as 16,815. Admissions due to diagnosis related to mental illness averaged 1,388 per day. Therefore, only 1.8 percent of all admissions were for mental health.

The Finnish stock market reached daily positive return on average by 0.04 percent. The volatility was 1.2 percent on average.

TABLE 1

Market returns and daily hospital admissions in Finland

Daily hospital admits is the number of people admitted to hospitals in Finland. *Daily admits for mental diseases* is the number of hospital admissions with diagnose code F00-F99 which refer to mental diagnosis.

	Mean	**SD**	**5th percentile**	**20th percentile**	**Median**	**80th percentile**	**95th percentile**
Daily hospital admits	76,092	16,815	47,545	61,007	79,134	88,174	101,238
Daily admits for mental diseases	1,388	273	877	1117	1463	1613	1762
Daily stock return	0.00043	0.012	-0.019	-0.009	0.0008	0.009	0.020

Results

Following Engelberg and Parsons, the basic regression is modeled as follows:

$$\ln(hospital\ admissions)_t = \propto * return_t + \beta * controls_{t+\tau} + \varepsilon_t \qquad (1)$$

This formation helps the interpretation of the results. As a dependent variable, the natural logarithm of admissions focuses into changes in amounts, rather than the actual amount. Finding he alpha for return is the main target of this study. Return is the Helsinki Stock Exchange market index OMXH25. As the hospital admission data is extremely seasonal, controls must be added to improve the usefulness of the model. The null hypothesis is that stock market return does not affect hospital admissions.

The dependent variable is the natural logarithm of daily hospital admissions in Finland. The market return is the daily OMXH25 return for market days between 2014 and 2016, scaled with the sample SD. Day of the week, month, and Holiday fixed effects are added in columns (2), (3) and (4). The Holidays include trading days before Easter, 1st of May, Midsummer and Christmas. Standard errors are in parentheses, as well as respective t-stat and R-squared values.

TABLE 2

Market returns and hospital admissions, increasing controls

Dependent variable: Log Hospital Admissions				
	(1)	(2)	(3)	(4)
Market return	0.004	0.002	0.001	0.002
(standard error)	(0.009)	(0.007)	(0.006)	(0.007)
Day of the week fixed effects	NO	YES	YES	YES

Month Fixed effects	NO	NO	YES	YES
Holiday Fixed Effects	NO	NO	NO	YES
Observations	752	752	752	752
t-stat	0.45	0.31	0.15	0.31
Lower bound 0.95	-1.30	-1.22	-1.15	-1.03
Upper bound 0.95	2.06	1.68	1.34	1.40
R-squared	0.0003	0.2577	0.4532	0.4816

TABLE 3

Market returns and hospital admissions, lead and lag effects

Dependent variable: Log Hospital Admissions							
	Day t-3 (1)	Day t-2 (2)	Day t-1 (3)	Day t (4)	Day t+1 (5)	Day t+2 (6)	Day t+3 (7)
Market return	0.002	0.001	0.005	0.002	0.002	-0.002	-0.008
(standard error)	(0.007)	(0.007)	(0.008)	(0.007)	(0.007)	(0.008)	(0.008)
Day of the week fixed effects	YES	YES	YES	YES	YES	YES	YES
Month Fixed effects	YES	YES	YES	YES	YES	YES	YES
Holiday Fixed Effects	YES	YES	YES	YES	YES	YES	YES
Observations	752	750	751	752	751	750	749
t-stat	0.22	0.13	0.67	0.31	0.24	-0.30	-1.01
Lower bound (0.95)	-1.24	-1.35	-0.97	-1.03	-1.28	-1.75	-2.35
Upper bound (0.95)	1.55	1.54	1.99	1.40	1.65	1.28	0.75
R-squared	0.3067	0.2572	0.2250	0.4816	0.2458	0.1902	0.1544

Table 2 shows the results on the main regression of the study. Including all trading days during the sample period, no statistically significant effect of market return on hospital admissions can

be found. Here, the effect is actually positive, i.e. one SD increase in stock market return would make hospital admissions to go up a bit. The results do not change when adding fixed effects throughout the columns. What is more interesting, is to look at the confidence intervals. In Panel A last column, I can reject the negative effect of more than 1.03 percent with the probability of 0.95.

Table 3 shows the results for any lead or lag relation of hospital admissions. Firstly, a lag relation could follow of news reaching investors not instantly, but for example next days newspaper. This turns the scope towards small household and amateur investors, as professional investors are aware of price changes continuously. The lead relation would be that changes in hospital admissions would be followed by stock market movements the following days.

Results look largely the same than in Panel A. Virtually no effects can be found. In the lag relation, the link seems to be inverse, so the declines in stock market would cause hospital admissions go up after two and three days, and vice versa.

Extreme returns

Engelberg and Parsons found the majority of effect in the lowest quintile stock market returns. The logic behind is that only a weakening in investor health will cause a possible admission to hospital, as good stock market performance would not have a contrary effect. I used the same specification, and the results are sown in the table.

Dependent variable is the natural logarithm of hospital admissions. For the daily market return, a dummy variable is added for each quintile except the middle one which is omitted.

TABLE 4

Market returns and hospital admissions, returns grouped by level of performance

	Bottom Quintile	Quintile 2	Quintile 4	Top Quintile
Market return	0.002	-0.019	-0.016	-0.017
	(0.029)	(0.021)	(0.021)	(0.027)
Day of the Week Fixed effects	YES	YES	YES	YES
Month Fixed Effects	YES	YES	YES	YES
Holiday Fixed Effects	YES	YES	YES	YES
Observations	752	752	752	752
t-stat	0.06	-0.90	-0.79	-0.62
Lower bound (0.95)	-5.51	-5.91	-5.67	-7.00
Upper bound (0.95)	5.87	2.20	2.43	3.65
R-squared	0.4826	0.4826	0.4826	0.4826

To examine the effect of specified market movements, the sample market returns are grouped into quintiles. Table shows the results. Only the lowest market returns made the hospital admissions to go up. For the other quintiles, hospital admissions went down.

TABLE 5

Market returns and hospital admissions, psychological diagnosis

	All mental illnesses
Market return	-0.002
	(0.006)
Day of the Week Fixed effects	YES
Month Fixed Effects	YES
Holiday Fixed Effects	YES
Observations	752
t-stat	-0.41
Lower bound (0.95)	-1.43
Upper bound (0.95)	0.94
R-squared	0.4583

Figure shows the results with hospital admissions for mental illness (codes F00-F99) admissions as a dependent variable. All controls are applied again.

Discussion

This study does not reveal a relation between stock market movements. Next, I am discussing some possible reasons for that. Firstly, the time span of the data set is obviously short. This is harmful on both sides of data. On the economical side, years 2014-2016 did not have much volatility, and sharp stock market movements were rare. The worst stock market days during the period did not cause hospital admissions to go up. On the healthcare data side, some fixed effects

are not detected without more data points. Moreover, the hospital data raises questions of autocorrelation, as the data does not separate actually new admissions. The admissions tend to follow their seasonal pattern more than stock markets. As Lin (2015) found out, in Taiwan stock market declines did make hospital admissions for mental disorders to go up between 1998 and 2009.

Conclusion

In this study I used hospital admission data from Finland between years 2014 and 2016 as well as Finnish stock market data to explore effects of stock market movements on investor health. After various tests, I am not able to reject the null hypothesis of no effect. Compared to Engelberg and Parsons study, an instantaneous effect of more than 1.03 percent for all symptoms can be rejected with the 95% confidence interval.

References

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Lin, C. -. L. (2015). Do stock prices drive people crazy? *Health Policy and Planning, 30*(2), pp. 206-214